

The Geant4 Simulation for the G2P and GEP Experiment at Hall A Jefferson Lab

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The G2P (E08-027) and GEP (E08-007) was recently completed at Hall A Jefferson Lab. The goal of the G2P experiment was to study the spin-dependent structure function g_2 for the proton at resonance region with low momentum transfer ($0.02 < Q^2 < 0.2 \text{ GeV}^2$). The GEP experiment was to measure the proton elastic form factor ratio at the same low Q^2 region. These 2 experiments shared the same dynamic nuclear polarized (DNP) NH₃ target except the orientation of the superconducting helmholtz magnetic. G2P required running the target magnetic field pointing to 90 degrees (pointing to horizontal left if looking downstream along the beam line) with 2.5 or 5.01 Tesla while GEP required that the target field stays at 6 degrees with 5.01 Tesla. Several beam energies ranged from 1.1 to 3.3 GeV have been used. G2P experiment are the first Hall A experiments that a transverse target field is used. In order to compensate the vertical bending of the incident electron beam while travel through the target field, a magnetic chicane was placed upstream from the target and a local dump were newly built and placed at 79 cm downstream. In order to reach low Q^2 , a pair of septum magnetics was placed at 157 cm downstream, which will bend the 5.65 degrees electron rays to 12.5 degrees so that they can reach the High Resolution Spectrometer of Hall A. A recoil proton detector, the 3rd arm, was also built to monitor the beam and target polarization. A Geant4 Monte-Carlo program was developed for these two experiments to simulate the beam line, target and septum field, the local dump, the 3rd arm and HRS detector acceptance. These simulation results will be presented.